UNITED STATES SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, Vasilios Vasiadis a citizen of the United States residing at 25-42 23 St. Astoria, NY 11102, have invented certain new and useful improvements in a

DEVICE FOR HANDLING AND ORIENTATING PILLS OR TABLETS IN A PRECISE MANNER

of which the following is a specification.

TITLE

DEVICE FOR HANDLING AND ORIENTING PILLS OR TABLETS IN A PRECISE MANNER

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. 119(e) of U.S. Provisional Application Serial No. 60/442,179 filed on October 29, 2002.

BACKGROUND

The invention relates to a new pill distribution system. Essentially, the invention relates a device for distributing pills or tablets in an automated form via a rotating wheel. Other pill distribution systems are known in the art, for example U.S. Patent Nos. 6,220,481; 6,227,345; 5,984,079; 5,826,696; 3,356,260 are known in the art and are all incorporated herein by reference.

SUMMARY

The invention relates to a device for distributing items such as tablets in a precise manner. This device comprises a rotating wheel that is driven by a motor in a circular manner and supported on a base on an axis, angled approximately 45 degrees. Disposed on a central region of this wheel is a container for holding a

plurality of tablets at random for future distribution. Along the periphery of this wheel is a new and inventive slot or distribution channel for receiving a plurality of tablets therein. This distribution channel is disposed on the base and is in communication with the container. There is at least one spring coupled to the base adjacent to the distribution channel. There is also at least one push pin disposed substantially in the base in a slidable manner, wherein the push pin is used to selectively slide against the spring, driving the spring open, opposite the distribution channel to allow an item to selectively enter the distribution channel and selectively leave the distribution channel. An adjacent pill or tablet then slides into a correct position around the periphery of the wheel for future distribution. This rotating wheel allows for a precise distribution of the tablets or pills from a central storage location. In addition, this device is capable of releasing one tablet or pill per track on each revolution so that up to 200,000 pills can be distributed in one hour.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present invention will become apparent from the following detailed description considered in connection with the accompanying drawings which disclose at least one embodiment of the present invention. It should be

understood, however, that the drawings are designed for the purpose of illustration only and not as a definition of the limits of the invention.

In the drawings, wherein similar reference characters denote similar elements throughout the several views:

FIG. 1 is as perspective view of the device;

FIG. 2 is a perspective close up view of the device shown in FIG. 1;

FIG. 3 is a top view of a section of the wheel shown in FIG. 2;

FIG. 4 is an exploded perspective view of the device shown in FIG. 1;

FIG. 5A is a side view of a first spring shown in FIG. 4;

FIG. 5B is a side view of a second spring shown in FIG. 4;

FIG. 6 is an exploded side cross sectional view of the device shown in FIG. 4;

FIG. 7 is a side cross-sectional view of the device shown in FIG. 6;

FIG. 8 shows a perspective, cross sectional view of the device shown in FIG. 1 showing the springs and the push pins fitting into the rotating wheel; and

FIG. 9 is a side, exploded cross sectional view of the device shown in FIG. 6, however this view shows the cover spring;

FIG. 10 is a perspective view of the reject and receiving system shown in FIG. 1;

FIG. 11 is a perspective view of a cam system shown in FIG. 10 wherein this cam system is positioned below a wheel shown in FIG. 10; and

FIG. 12 is a perspective view of a cam system for driving the push pins and springs shown in FIG. 9 wherein this cam system is positioned below a wheel shown in FIG. 10;

FIG. 13 is a perspective view of an advancing cam system wherein this cam system is positioned below a bottom end of the wheel shown in FIG. 1;

FIG. 14 is a side view of the advancing cam system shown in FIG. 13, showing two different cams working together;

FIG. 15 is a perspective view of the sensor holding system for holding the sensor to the wheel shown in FIG. 1;

FIG. 16 is a perspective view of another embodiment of the invention;

FIG. 17A is a top view of a second embodiment of a cover;

FIG. 17B is a side view of the embodiment shown in FIG. 17A;

FIG. 18A is a top view of a second embodiment of a short spring;

FIG. 18B is a side view of the embodiment shown in FIG. 18A;

FIG. 19A is a top view of a second embodiment of a long spring;

FIG. 19B is a side view of the embodiment shown in FIG. 19A;

FIG. 20A is a top perspective view of a spring lock;

FIG. 20B is a bottom perspective view of the spring lock shown in FIG. 20A;

FIG. 21 is a close up perspective view of the embodiment shown in FIG. 16;

FIG. 22 is a perspective view of the embodiment shown in FIG. 21 with the wheel removed;

FIG. 23 is a perspective view of a cam system;

FIG. 24 is a perspective view of a laser system;

FIG. 25 is a perspective view of a sensor system;

FIG. 26A is a side view of a first type pill or tablet;

FIG. 26B is a side view of a second type pill or tablet;

FIG. 27A is a side view of a first position of the springs;

FIG. 27B is a side view of a second position of the springs;

FIG. 27C is a side view of a third position of the springs;

FIG. 27D is a side view of a fourth position of the springs; and

FIG. 28 is a flow chart for the process for distributing tablets.

DETAILED DESCRIPTION

Referring in detail to the drawings, FIG. 1 is a perspective view of the device, wherein there is shown a device 10 for distributing items such as tablets in a precise manner. This device comprises a base 11 having a stand 12, a base plate 14, and a rotating wheel 20. Rotating wheel 20 rotates on an approximately 45-degree angle from point 15A which is a bottom point and to a top point 15B. Coupled to this base 11 is at least one container 18 for holding the items or tablets. Container 18 has an opening at a bottom region so that pills or tablets can be conveyed into slots in rotating wheel 20 when these slots pass point 15a. In addition, coupled to wheel 20 and to base 11 are two receiving systems 16a and 16b. These two receiving systems are a product or tablet reject 16a, and a good tablet receiver 16b. A laser system 16c is used to laser drill or burn a hole in a respective tablet There is also a sensor system 16d (See FIG. 22) which verifies that the tablet is in good condition and in the correct position and also identifies each slot or channel on the wheel. If sensor system 16d

detects that a tablet is damaged or should be rejected, the tablet is sent to tablet reject 16a. These receiving systems are for receiving a feed of tablets from central container 18. There is also a rotating motor 17 coupled to base plate 14 which turns wheel 20 around. In addition, there is also a computer 21 which can be coupled to base 11 or stored in a remote location. Computer 21 is in communication with sensor system 16c wherein sensor system 16d not only tracks the quality of each tablet or pill but also identifies and tracks the location of each distribution channel (See FIG. 2) on wheel 20 to accurately track the number of pills being distributed.

FIG. 2 is a perspective close up view of the device shown in FIG. 1, wherein there is shown at least one distribution channel 32 disposed in wheel 20. Distribution channel 32 is in communication with container 18 and extends from container 18 to a peripheral region of wheel 20. Adjacent to distribution channel 32 on wheel 20 is a plurality of top side screw holes 22a, 22b; inner hole 25, intermediate screw holes 26a, 26b, and outer advancing hole 28a, and outer release hole 28b. These screw holes 22a, 22b, 26a and 26b are for receiving a plurality of screws while the remaining holes 25, 28a, and 28b are for receiving push pins. There is also a hole or gap 29 which allows viewing of a tablet residing in a peripheral region of distribution channel 32 and also for access by a laser from an underside region onto a respective tablet.

FIG. 3 shows a top view of this distribution channel wherein positioned at a peripheral region of distribution channel 32 is an open hole 29. As shown in this view, push pin holes 25, 28a and 28b are shown which are designed to allow push pins 70, 72, and 74 (See FIG. 4) to be slidably engaged therethrough. In addition, also shown in this view are screw holes 26a, and 26b and platform or spring receiving slot 30.

FIG. 4 is an exploded perspective view of the device shown in FIG. 2, wherein there is shown at least one spring which can be in the form of a first, a long, or advancing spring 40, a second, short or release spring 50 and a optionally a cover or cover spring 90 (See FIG. 8). These springs are coupled to indented platforms on rotating wheel 20. Screws 60a and 60b are used to secure springs 40, and 50 to rotating wheel 20 through screw holes 26a and 26b (See FIG. 2). By securing springs 40 and 50 in their middle region to a central portion of platform 30, these springs function as leaf springs bending up and down to receive tablets 35 that move along channel 32. To control the movement of tablets 35 along channel 32 there is at least one push pin which can be in the form of an inner push pin 70, an outer advancing push pin 72 slidably disposed in hole 28a, and an outer release push pin 74 slidably disposed in hole 28b. These push pins are disposed substantially in wheel 20 in a slidable manner along each channel 32. These push pins 70, 72 and 74 are designed as two part push pins. For

example, a primary inner push pin 70a drives against secondary inner push pin 70b to form one push pin 70. Primary outer advancing push pin 72a drives against secondary outer advancing push pin 72b while primary outer release push pin 74a drives against secondary outer release push pin 74b.

When in operation, this device uses the secondary push pins to selectively slide against springs 40, 50 to drive these springs open, opposite a bottom section of distribution channel 32. This movement allows an item to selectively enter distribution channel 32 and selectively leave this distribution channel or slot 32 at selected points.

FIG. 5A is a side view of a first or advancing spring 40 shown in FIG. 4. An advancing spring 40 has a plurality of drill holes 46a and 46b located in a central region of the spring to receive screws 60a and 60b (See FIG. 4). This spring has a central solid region 41, curved corners 44a and 44b, a curved end 42 an indented region as well as a U-shaped end 47 opposite curved end 42, with U-shaped end 47 comprising legs 48a and 48b. U-shaped end 47 is shaped to hold pills or tablets in place while still allowing these pills or tablets to be viewed by a sensor or to be struck or burned via a laser shining through u-shaped region and into a surface of a tablet.

FIG. 5B is a top side view of second, short or release spring 50 also shown in FIG. 3. Second spring 50 includes a central body region 51, a plurality of screw holes 52a and 52b, to receive screws 60a and 60b an additional hole 54 a curved corner 55 and a U-shaped end 56 having legs 58a and 58b respectively. U-shaped end 56 is designed to allow a sensor to view the pill or tablet, and also to allow a laser beam to have access to the pill or tablet, while legs 58a and 58b are used to hold the pill or tablet in place.

FIG. 6 is an exploded side cross-sectional view of the device shown in FIG. 4. As shown, there are a plurality of tablets 35 disposed in a central storage location 18. The tablets slide out of this central storage location through a channel 37 connecting hopper 18 to distribution channel or slot 32 and into wheel 20 (See FIG. 1). These tablets slide down channel 32 (See FIG. 2) up to gap 29. As shown, screws 60a and 60b fit into springs 40 and 50 to secure them to wheel 20 through screw holes 26a and 26b. In addition, wheel 20 has a series of holes 25 and, 28a and 28b for receiving primary push pins 70a, 72a and 74a and secondary push pins 70b, 72b, and 74b. Primary push pins 70a, 72a and 74a are disposed below secondary push pins 70b, 72b and 74b as shown in FIG. 7.

FIG. 8 shows two separate advancing cams 82 and 84 and also

the addition of cover spring 90 which is used primarily to cover channel 32. Cover spring 90 rests below first or advancing spring 40 and second or release spring 50 on wheel 20 so that it covers channel 32 as shown in FIG. 9. All of the springs can be made from a flexible metal material such as steel or aluminum wherein these springs 40, 50, bend as they are pushed up by secondary push pins 70b, 72b and 74b. Advancing cams 82 and 84 are unlike the previous cams in that they are not adjustable up or down. These cams 82 and 84 provide permanent support for driving the push pins up. For example, inner cam 82 is for driving spring 40 up in an inner peripheral region to advance pills or tablets into slot 32 while outer cam 84 is for driving up the associated push pins 74a and 72a up through slots or holes 28a and 28b to push springs 40 and 50 up to allow these pills to advance forward in slots 32.

FIG. 10 is a perspective view of the reject and receiving or eject system shown in FIG. 1. This view shows rotating wheel 20 which rotates past tablet reject 16a and also past good tablet receiver or eject system 16b. There is a solenoid 100 that is in communication with computer 21, wherein upon computer 21 receiving signals from sensor system 16d, computer 21 selectively activates solenoid 100 to act on lever arm 105 to rapidly raise or lower a cam about pivot 107. For example, if solenoid 100 receives a signal from computer 21 to push up, then the portion of lever arm 105 adjacent to solenoid 100 drives up and a distal end of lever

arm 105 coupled to cam 110 (see FIG. 11) moves down causing cam 110 to move away from a bottom section of wheel 20 thus allowing the tablets to remain in distribution channel 32. However, if solenoid 100 receives a signal from computer 21 to drive down, then the portion of lever arm 105 adjacent to solenoid 100 drives down with solenoid 100 and a distal end of lever arm 105 moves up causing cam 110 to make contact with the push pins.

FIGS. 11 and 12 show two different perspective views of a cam system 103 shown in FIG. 10 wherein cam system 103 includes solenoid 100, lever arm 105, pivot 107 and cam 110. Cam system 103 is positioned below wheel 20 shown in FIG. 10. Cam system 103 also includes a spring 112 which is coupled at one end to lever arm 105 adjacent to cam 110 and coupled at an opposite end to a static base 114. Spring 112 keeps cam 110 biased down so that cam 110 is kept away from the push pins in a resting state. Static base 114 is ultimately coupled to base 11 underneath wheel 20. There is also an air gun 125 coupled to static base 114 which directs air towards the tablets housed in distribution chamber 32.

FIG. 13 is a side view of a reject cam system 130 and a reject cam system 140 each comprising cam systems 103 described above. This cam system is positioned below a bottom end of the wheel shown in FIG. 1. Reject cam 130 is positioned at an outer end of wheel 20 and eject cam 140 is also positioned at an outer

end of wheel 20. Cams 130 and 140 are positioned so that they are always in contact with push pins 74a which drive up against pins 74b and driving up an outer end of spring 50 to allow the release of a tablet. In this case, cams 130 and 140 only act on spring 50 by pushing spring 50 up via push pins 74a while leaving spring 40 and the remaining push pins alone. This allows one single tablet to advance from its distribution position without allowing additional tablets to move because the remaining tablets are held in place by spring 40.

FIG. 14 is a perspective view of reject cam system 130 shown in FIG. 13, showing this reject cam system 130 positioned under wheel 20.

FIG. 15 is a perspective view of the sensor application system 150 for holding a sensor. In addition there can also be a laser application system that holds a first laser 152 and a second laser 154 adjacent to wheel 20 shown in FIG. 1 at position 16d. First laser 152 is for applying a laser beam to a bottom side of a tablet positioned at a peripheral region of wheel 20. Second laser 154 is for applying a laser beam to a top side of a tablet positioned at this peripheral region.

In operation, wheel 20 rotates around from and from a first position encounters cams 82 and 84 while being driven by

motor 17. At a low point, 15a, cams 82 and 84 act against primary push pins 70a, 72a, and 74a drive secondary push pins 70b, 72b, and 74b, up, with secondary push pin 70b being driven up by cam 82 and thus driving up an inner region of advancing spring 40 to open the slot to tablets. Cam 84 acts as a double cam and drives up secondary push pins 72b and 74b driving up an outer region of advancing spring 40 via push pins 72b, with secondary push pin 74b driving up release spring 50. Because cam 82 drives up an inner region of advancing spring 40 this lets in at least one tablet 35 in an inner end of distribution channel 32. Cam 84 acts on push pins 72, and 74 while allowing additional tablets in distribution channel 32 to slide to a periphery, thereby allowing distribution channel 32 to fill up. At this peripheral region at the low point 15a, there is a boundary or guide wall formed by plate 14 which keeps tablets 35 in distribution channel 32 even though these springs 40 and 50 are in an up position. At this point, there is at least one tablet disposed in a peripheral region of distribution channel 32 wherein this tablet is subsequently held in place by spring 50.

As this distribution channel 32 rotates past laser system 16c, the tablet is hit with a laser on at least one side through a gap or u-shaped end 56 in spring 50 or through hole 29 in wheel 29. At this point the tablet will be examined for its color. The different color codings on the tablet may be for the different

coatings that can be applied to the tablet. The color codings are important because with certain type tablets only one side of a coated tablet would need to be acted on by a laser. Information about the color of the tablet is relayed to computer 21. Computer 21 then instructs either laser 152 from a top side or from laser 154 from a bottom side to act on the tablet. Thus, laser 152 acts on the tablet through the U-shaped sections 47 and 56 of springs 40 and 50, while laser 154 acts on the bottom face of tablet through hole 29 in distribution channel 32.

If there are any problems or imperfections with the tablets, then, as this distribution channel 32 passes product or tablet reject 16a, computer 21 signals solenoid 100 to drive cam 110 up against primary push pin 74a to activate secondary push pin 74b to drive release spring 50 up to release a tablet 35 in the peripheral region and dispose of this tablet into tablet reject 16a. Because primary push pin 74a and secondary push pin 74b are only used to drive spring 50 open, only one tablet on the periphery slides out of distribution channel 32, while the remaining tablets are held in place at both the inner end and the outer end by spring 40.

However, if sensor system 16d does not find any imperfections or errors a tablet, then the tablet remains in distribution channel 32 until reaching good tablet receiver 16b. At this point cam 140 is biased in an up position to release a pill or tablet from the

slot as described above.

The activation of primary push pins 70a, 72a, and 74a along with secondary push pins 70b, 72b and 74b is controlled by computer 21 and the respective cams which is in communication with sensor 16d so that each distribution channel 32 is tracked as it rotates around. Sensor 16d is in communication with computer 21 so that if sensor 16d discovered a damaged pill in one particular distribution channel 32, computer 21 would track that particular distribution channel 32 so that when that distribution channel 32 reaches tablet reject 16a, primary push pin 74a is activated, which drives secondary push pin 74b up to release the damaged tablet into tablet reject 16a. By tracking the location of each distribution channel, and the number of rejected tablets 32, computer 21, also tracks the number of tablets released into good tablet receiver 16b so that an exact number of tablets are distributed into a bottle or other container at a receiving end of good tablet receiver 16b.

Thus, during operation, tablets 35 are lined up in channel 32 (See FIG. 8) so that there is a controlled and continuous flow of tablets out of each channel 32. This feature is important because a specific and accurate number of tablets must be distributed into each container so that receptacles receiving extremely valuable tablets do not receive an inaccurate number of tablets or damaged tablets. Because of this design, sensor 16d working with computer

21 can accurately distribute and track up to 200,000 pills an hour.

FIG. 16 discloses a perspective view of a second embodiment of the invention wherein both embodiments are substantially similar with only the differences between the two discussed below. In this embodiment, there is shown device 200 which is disposed adjacent to a separate housing 190 which is used to house laser controller 192, computer 194 and laser system 300. Hot air is circulated out of this housing via a vent or skirt 197. These different components will be explained in greater detail in the following paragraphs. Device 200 is very similar to the previous embodiment in that it comprises a wheel 20, a plurality of slots or distribution channels 32 and a plurality of springs disposed in these slots.

In this design, there are also a new set of springs and spring mechanisms that are used to help feed tablets or pills. For example, as shown in FIG. 17A there is a top view of a spring or slot cover 240 which has a main body 241 and a first end which has a first spring tine 242, a second spring tine 244 surrounding a u-shaped region or cut out 243 on this end. At the opposite end is a leg region 245 which has a shorter cross sectional area than body area 241 and an extending section 246 extending out from leg region with a smaller width than leg area or region 245.

Extending section 246 is used to extend over on to cover a tablet residing in a slot or distribution channel 32. There are also screw holes 247 and 248 wherein these screw holes are for aligning with other screw holes in other springs to receive screws 60a and 60b to help with fixing spring cover to wheel 20. FIG. 17B shows a side view of spring cover 240 shown in FIG. 17A.

FIG. 18A shows a top view of short spring 250 which contains a body section 251, a first set of screw holes 252, and a second set of screw holes 253 for securing short spring to wheel 20 and to long spring 270. Body section 251 has a cut-out section 255 which is used as an indent to create greater flexibility in short spring 250. Short spring 250 is approximately ½ of the length of long spring with screw holes 252, and 253 matching with screw holes 247 and 248 respectively on long spring 270. At an end of short spring 250 are a plurality of tines 256, and 257 which surround a u-shaped cut-out 258. As a tablet slides in a slot, it slides into u-shaped cut out 258 and is held there until it is dispensed. FIG. 18B shows a side view of spring 250 wherein in this view, spring 250 is bent to control the outflow of tablets in a slot. For example, a first or a back region 259a, is angled up to an arched region 259b which corresponds to cut out section 255 and arcs down to bent section 259c which is bent at an approximately 90 angle. Spring 250 then flattens out to flat section 259d which corresponds to tines 256 and 257 on spring 250.

The spring is bent in this manner to form a pre-biased spring which catches and holds tablets as they are sliding through their respective slots.

FIG. 19A shows a top view of long spring 270 which is used to cover the associated slot and spring cover 240 and is then covered by short spring 250 similar to that shown in FIG. 8. Long spring 270 has a body section 271, a plurality of screw holes which include a first set of screw holes 272 and a second set of screw holes 273 to receive screws 60a and 60b. A back cut-out section 274 is used to allow viewing of the tablets sliding through their respective slots and also to reduce the cross sectional area to increase flexibility in bending in long spring 270. In addition, a back extension arm or member 275 is used to cover a remaining portion of the slot and extends down to block passage of tablets in the slot. Opposite back extension arm or member 275, is an opposing extension arm 276 which extends out to extending tines 277 and 278 which surround a u-shaped cut out 279.

FIG. 19B shows a side view of this long spring 270 which shows that this long spring has both ends bent down. The first receiving end 275 is bent down in a U-shaped profile to prohibit tablets from flowing into a slot. The other side, that of end 276 is bent down to hold all remaining tablets in the slot while one individual tablet is being dispensed when short spring 250 is

being lifted. This design allows a sensitive, and controlled release of tablets from a distribution channel 32.

FIG. 20A is a perspective view of spring lock 260 which is used to clamp down on spring cover 240, long spring 270 and short spring 250. Spring lock 260 has a substantially square shaped body 261 and has two screw receiving holes 263 and two posts 262 which insert into holes 247 on spring cover 240, holes 252 on short spring 250, and holes 272 on long spring 270 to secure these elements down. In addition, when spring lock 260 is clamped down to wheel 20 via screws, or posts it forms a support to keep spring cover 240 over its respective slot, and also to keep short spring 250 and long spring 270 clamped down. FIG. 20B shows spring lock flipped over as compared to FIG. 20A to show the different features of spring lock 260 described above more closely. When all of the springs are clamped down, short spring 250 is just under spring clamp 260, above long spring 270 and extends out farthest to an outer peripheral region with tines 256 and 257 extending out past tines 277 and 278 on long spring 270 and also out past the outer peripheral regions of spring cover 240. In addition, the body 251 of short spring 250 extends peripherally out past long spring 270 so that it can be hit by push pin 74 while push pin 74 is clear of long spring 270. In addition, long spring 270 sits between short spring 250 and spring cover 240 and extends peripherally out past spring cover 240 so that it can be

hit and acted on by push pin 72 which would not hit spring cover 240. This layered effect is shown by way of example in FIGS. 9 and 27A-D.

FIG. 21 shows view of this other embodiment of the device 10a which shows wheel 20 placed upon base plate 14 and having a container or central hopper 18 with an inner hopper ring 180. Wheel 20 is positioned at an approximately 45 angle with respect to the ground. In this case, there is a feeder assembly 208 which includes a hopper 210 having a spout 212 wherein assembly 208 is supported by a support arm 214, and a support stand 215. Feeder assembly 208 is for feeding pills into hopper 18 but radially outside inner ring 180.

Reject chute assembly 216a is substantially similar to tablet reject 16a while eject chute assembly is substantially similar to good tablet receiver 16b. In this embodiment, there are two stuck tablet catch box assemblies 232 and 234 with a first stuck tablet catch box assembly 232 disposed adjacent to, and downstream from reject chute assembly 216a and a second stuck tablet catch box assembly 234 disposed adjacent to, and downstream from eject chute assembly 216b.

In this case, if a particular tablet was not rejected or ejected from its particular slot, then the wheel is stopped from

rotating and the tablet is removed in either of these two assemblies 232 or 234.

FIG. 22 discloses a similar view as that of FIG. 21 however, in this view, wheel 20 is removed from service along with hopper 18. This view exposes reject cam assembly 235 and eject cam assembly 237 which are designed similar to cam system 103 shown in FIGS. 11 and 12. In this view there is also shown a wheel handle 222 which is used to grasp and manually control the wheel assembly and also a wheel hub 224 which is used to receive wheel 20. Wheel hub is positioned on base driving wheel 225 wherein wheel 20 sits on base driving wheel 225 and is secured thereto via a coupling to wheel hub 224. Thus, with this design, wheel 20 is removable from the entire assembly.

Disposed adjacent to driving wheel 225, is a fume extractor 226 which extracts any dust or particles associated with the operation of this wheel. This fume extractor pulls any dust or other particles from the rotating wheel to keep it from breaking down and to also keep any additional dust off of the machine and the associated tablets. A verification sensor 227 is disposed between fume extractor 226 and eject cam assembly 237. This verification sensor 227 is used to determine whether a particular pill or tablet to be extracted is in proper condition for extraction. Verification sensor remains in communication with

computer 194 so that if a pill or tablet is not in condition for extraction, reject cam assembly 237 is notified to raise the associated cam so that the associated pill or tablet is not rejected.

Disposed adjacent to reject cam assembly 235 is reject verification sensor system 238. Reject verification sensor system detects whether this tablet which should have been rejected was actually rejected. If the tablet was not rejected, then computer 194 sends a signal to first stuck tablet catch box assembly 232 to stop the rotation of wheel 20 and remove the faulty tablet.

In addition, this view also exposes an eject sensor verification system 239. This sensor system determines whether there is a stuck tablet which should have been ejected by eject system 234. If the tablet was not ejected by eject system 234, then computer 194 sends a command to stop wheel 20 from rotating so that this tablet can be ejected into second stuck tablet catch box assembly 234.

Disposed adjacent to stuck tablet catch box assembly 234, is an advancing cam assembly 280 that is different than advancing cam assemblies 130 and 140 in the previous embodiment. This advancing cam assembly disposed adjacent to tablet guide plate 294 has an inner ring 284 and an outer ring 282 which are shown in greater

detail in FIG. 23. Inner ring 284 and outer ring 282 are separated by a spacer cam plate 285 and are supported by a stand 287 which are used to support the different cams 282 and 284. There is also an inner cam plate 283 which separates these cams from driving wheel 225.

First cam plate 282 is coupled on a radially outside region of inner cam 284, while spacer cam plate 285 is located on a radially inside region of cam 282 but radially outside of inner cam 284. Cam stand 287 then supports this entire apparatus so that it can be supported above base plate 14.

Essentially, the first cam assembly is the tablet locating cam 282 which is formed as a substantially annular sloping rim, with a first ramped portion 282a which forms a receiving section for receiving push pins associated with pushing up the associated springs. There is an elevated portion 282b which keeps the push pins elevated and thereby the springs 270, and 250 elevated as well. Finally, there is a third region, which is a down ramp 282c which allows the associated push pins, and thereby the associated springs to move back down.

Second cam assembly or tablet input track cam 284 is radially inside of first cam assembly 282 which is the tablet locating cam. Cam 284 is also in a partial circular or annular shape which also

has an initial region 282a which is in the form of a ramp. When the wheel rotates, the associated push pins encounter ramp 282a wherein they are driven up to open long spring 270 so that tablets will flow into the respective slots. Ramp 282a leads to a central region 282b which is a consistently elevated region which keeps the push pins raised up keeping the springs up and open allowing the tablets to flow into the slot.

Thus, as wheel rotates, cam 280 is used to allow tablets to slide or advance out to a radially outside or peripheral region on wheel 20 wherein this creates a gap at a back end of the slot. Cam 284 is thus used to raise long spring 270 on a radially inside region so that additional tablets can enter into the slot and recharge the load of tablets in each slot.

Adjacent to cams 282 and 284 is an open region both above and below wheel 20. This region is for receiving laser 300.

FIG. 24 shows Laser 300, which comprises a first laser element 302 and a second laser element 304. First laser element 302 is positioned above wheel 20 while second laser element 304 is positioned below wheel 20 when in the active position. When not in use, and when in an inactive position, laser 300 is disposed or housed in housing 190 shown in FIG 16. Lasers 302 and 304 slide on rails 320 which allow the lasers to slide from the inactive

position to the active position surrounding wheel 20. There is also a slide cylinder 322 which drives lasers 302 and 304 back and forth on rails 320. Lasers 302 and 304 are coupled to rails via slide 326 which slides on rails 320 when being driven by slide cylinder 322. There are also two slide lock assemblies 324 which lock lasers 302 and 304 in place either in its fully retracted and resting position, or in its active position. A sensor holding assembly 330 is disposed between the two lasers 302 and 304. This sensor holding assembly 330 is shown in greater detail in FIG. 25 and shows two different sensors 332 and 334 coupled to an extension pole 331 wherein these sensors are actually color sensors to determine which color side a color-coded tablet or pill is facing with respect to each of the lasers. These sensors 332 and 334 are then used to indicate which side of the tablet is to be hit with a laser.

Lasers 302 and 304 are slidable on these tracks because these lasers must be removed from the region of wheel 20 so that they can be periodically cleaned. Thus, on a periodic basis, lasers 302 and 304 are pulled away from wheel 20 and then cleaned inside housing 400 so that they can remain effective.

In this case, lasers 302 and 304 are positioned both above and below wheel 20 so that either one side or both sides of a tablet can be hit with a laser beam.

Many time release tablets are structured so that they have a coating which provides a protective coating against quick digestion. However, if the entire tablet is coated with this coating, then it would not dissolve in a user's stomach. Therefore, a small hole is burned into the tablet which allows a particular amount of medicine to be available to a person=s system at one time. Tablets such as those described can be shown in FIG. 26A wherein a first style tablet has an inner medicinal region 402 and an outer non-medicinal coating 404. There can also be a laser drilled hole 406 which allows this inner medicinal section to flow out and be absorbed by a user=s body.

FIG. 26B shows a profile of a rounded tablet having two different sides as shown by first side 420, second side 430, wherein these sides can be in the form of a coating, coating a center region 432. There is a laser drilled hole 434 on first side 420 which allows a timed release of medicine from center region 432. There can also be an optional second laser drilled hole 436 which is shown by dashed lines. The additional hole can be drilled to speed up this timed release feature.

FIGS. 27A, 27B, 27C and 27D show a side view of a progression of use of components 240, 250, 260 and 270 for use with device 200. This progression is followed using the following flow chart shown in FIG. 28. As shown in FIG. 28, step 1 involves filling a

hopper 18 with tablets from an initial hopper 210 wherein the tablets flow through spout 212 and into an outer ring in hopper 18. Next, step 2 of this process involves rotating wheel an marking a location of each spot on the wheel for each slot. Computer 194 controls this process wherein it sends a signal to motor 17 to start rotating driven wheel 225 which then rotates wheel 20 around.

Next, step 3 involves filling each slot with tablets so that each slot is substantially or entirely filled with tablets. This step is shown in greater detail through FIGS. 27A and 27B.

In this embodiment, long spring 270, short spring 250 and spring lock 260 and cover spring 240 are used to control the flow of tablets through wheel 20. FIG. 27A shows a first position which occurs at a point near the bottom of the wheel, wherein long spring 270 is shown in a closed position on an in-feed side and open on an out-feed side. These four views show the basic flow of tablets down a slot.

In this first position, shown in FIG. 27A the out-feed side is shown open, so that it can advance any tablets that are present in the system forward. This position starts when each pin in each slot contacts outer cam 282. Short spring 250 thus is pushed up into an open position via outer cam 282 so that a pill or tablet

can be advance forward to tablet guide 294. In this case, eject cam 282 acts on short spring 250 to push it up. In this open position, long spring 270 remains clamped down on any remaining tablets feeding into the system while short spring 250 is pushed up off of a tablet in a feeding position to allow any tablets in the slot to move forward to make room for a supply of new tablets. The tablets do not flow out of these slots because they are held in place by tablet guide 294 which is essentially a flat support plate.

In the second position, as shown in FIG. 27B the in-feed side is open and is used to receive tablets until wheel 20 rotates past the region where the springs are elevated. This in-feed side is normally closed by long spring 270 and biased closed by spring lock 260 which couples long spring 270 and short spring 250 to wheel 20. Long spring 270 is coupled to wheel 20 in a center region of long spring 270 so that it forms a leaf spring at both ends, at both the in-feed side and the out-feed side. This position as shown in FIG. 27B shows that long spring 270 is pushed up by constant cam system or cam assembly 280. In this case, the inner ring 284 of cam assembly 280 automatically pushes up long spring 270 so that the tablets will in-feed into each slot and fill each slot with tablets. Thus, in this case, the in-feed position is open while the out-feed position is closed. Thus, in this position, short spring, is not acted upon any of the cams so

that it remains in its biased closed position. This position occurs after each slot rotates past outer cam 282 while still rotating thorough the region of inner cam 284.

Next, in step 4, wheel 20 rotates for a sufficient number of revolutions so that computer 194 detects the presence and in step 5 the color scheme of tablets in each eject spot in each slot. An eject spot for each slot is one where the tablet is positioned under u-shaped recess 258 of short spring 250.

Verification sensor 227 is used to determine whether all of the tablets are in their proper spots. If verification sensor 227 determines this state, then wheel 20 continues to rotate until it reaches laser system 300. At this point and during step 5, color sensors 332 and 334 are used to determine the color and associated orientation of each tablet. For tablets having two different colored faces, laser system may only be instructed to shoot one particular colored face. Once laser computer 192 determines this orientation, in step 6 it instructs either laser 302 or laser 304 to shoot a laser either from above or below wheel 20 to strike one face of the tablet. As wheel rotates past this laser shot region, any fumes generated from this laser shot are extracted from fume extractor 226.

As each laser-shot tablet rotates up and around, it passes

verification sensor 227 which is in communication with computer 194. Verification sensor 227 verifies visually that each pill has actually been struck by either one or more of lasers 302 or 304 and that the pill is ready to be dispensed. In this case, verification sensor includes sensors positioned both above and below wheel 20 to view both sides of each tablet. This occurs while springs 270, and 250 are in their third and closed-closed position shown by FIG. 27C. In this case, both the in-flow and the outflow positions are closed so that any tablets cannot be inserted into or removed from their associated slot.

If sensor 227 determines that a particular tablet or pill has an imperfection or has not been acted upon by one or more of lasers 302, then sensor 227 sends a signal to computer 194 to raise an associated cam with reject cam assembly 235 so that this cam acts upon the associated push pins to raise short spring 235 (See FIG. 27D) to dispense an imperfect tablet through reject chute assembly 216a. If this tablet is somehow stuck in its associated slot, then it is detected by reject verification sensor 238 whereby reject verification sensor 238 sends a signal to computer 194 to stop wheel 20 from rotating so that it can be then rejected via reject stuck tablet catch box assembly 232.

Otherwise if an imperfect tablet has been successfully removed, or if the associated tablets are all in dispensable

condition, wheel 20 keeps rotating to eject cam assembly 237. At this point, and as stated above, eject cam assembly remains in a biased up position wherein the

Finally, once the system has determined that the tablet can be dispensed, or ejected, as shown in step 7, eject cam assembly uses eject cam 236 to push up on associated push pins (See FIGS. 6-9) to push short spring 250 up to its eject position as shown in FIG. 27D. At this position the associated tablet can either move out of its associated slot or distribution channel 32 into eject chute 216b or reject chute 216a as described in step 8. If this tablet that was supposed to be ejected somehow became stuck, then stuck tablet catch box assembly 234 is used to eject that stuck tablet. Wheel 20 then rotates back around to the beginning to continue this process.

Accordingly, while at least one embodiment of the present invention has been shown and described, it is to be understood that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention as defined in the appended claims.